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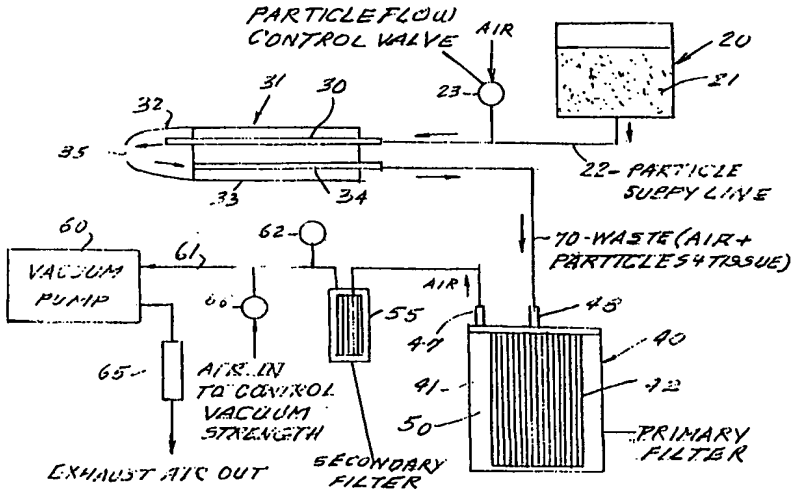

(57) Abstract

A novel handpiece and system for abrasion of skin is disclosed. A short handpiece (31) with a threadably movable tip (32) is used. The opening (35) in the tip (32) is centered on the handpiece (31) axis and a small diameter particle input channel (30) and diameter larger output channel (34) are both offset from the handpiece axis. A central blade is integral with the tip and divides the tip into two volumes which each communicate with the opening and respective ones of the input and output nozzles. A vacuum control opening is formed in the tip for easy control by the operator. Abrasive particles and removed tissue are applied to the interior of a cylindrical filter (42) supported within a support can (41). The annular area between the can (41) and filter (42) is connected through a secondary emergency filter (55) to a vacuum pump (60). The cylindrical filter (42) can be a flexible filter bag. A large source (20) of abrasive particles (21) is coupled to the handpiece inlet and the filter is coupled to the handpiece outlet.

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SKIN ABRASION DEVICE

FIELD OF THE INVENTION

This invention relates to the removal of surface portions of dead or living tissue, sometimes termed microdermal abrasion and more specifically relates to an improved apparatus and process for the abrasion of surface portions of human tissue by the controlled flow of abrasive particles.

BACKGROUND OF THE INVENTION

Apparatus for the microdermal abrasion of the surface of tissue (living or dead) is well known. In these processes, a stream of abrasive particles such as sand is applied to the surface of the tissue or skin through an opening in a hand held tool (termed a handpiece) which is sealed against the skin. The tool and the particle stream is controllably scanned over the area to be abraded. The abrading particles and the removed tissue are then collected by vacuum in the handpiece and are passed through and collected by a filter to prevent the escape of the abraded tissue and sand into the vacuum pump and ambient atmosphere.

The handpiece has taken many forms in the past but usually provides a first passage for conducting abrasive particles from a reservoir to the area to be treated and a second parallel channel for conducting the particles and abraded skin away from the area treated and into a disposal vessel.

A typical prior art apparatus is shown in U.S. Patent 5,037,432. The hand-held head of this patent is a long tubular structure having an off-

center hole which permits the application of an abrasive particle jet to an area to be treated, and the subsequent removal of the particles and abraded skin. The off-center outlet hole is arranged to be on the same axis as the input abrasive particle jet which then reaches the area to be treated at a 45° angle. The outlet jet channel facing the opening has a nozzle restriction. The abraded skin and used particles are then withdrawn through a parallel return vacuum channel which is connected to a vacuum pump through a filter.

The above described hand held tool has a number of drawbacks. Thus, because it is relatively long (longer than about 5 inches) it is difficult to manipulate easily over a curved surface area to be abraded, for example, the surface of a human face. Further, the vacuum pressure within the hand tool is not easily changed by the operator when a weaker or more forceful jet of abrasive particles is desired at particular locations on the surface area being abraded. Further, the handpiece is subject to clogging at the restricted outlet nozzle, requiring the operator frequently to stop the treatment and clear the nozzle.

The above described handpiece is provided with a removable and disposable tip or bell section which contains the output hole. Thus, the tip can be removed and disposed of and replaced by a new tip after the treatment of each individual. The tip is normally press-fit onto the body of the handpiece and is tightly sealed thereto to prevent accidental escape of abraded skin and loss of vacuum. Therefore, the tip is very difficult to remove and replace.

It would be very desirable to provide a handpiece for abrasion of living tissue which avoids the above problems.

The abrasive particles and tissue which are removed in prior art devices are collected in a filter placed between the handpiece outlet channel and the vacuum pump. Such a filtration system is shown in U.S. Patents 5,100,412 and 5,207,234 in the name of Rosso. The filter shown therein is an inverted cup at the outlet opening of a waste receiving chamber. The outlet opening is connected to the vacuum pump line and contaminated particles and debris flow from the cup exterior toward its interior thus building up on the cup exterior. This filter tends to become quickly clogged and becomes more and more imperious to the flow of air therethrough. Consequently, the system must be frequently turned off and the filter must be cleaned sometimes during and frequently after each use.

It would be very desirable to provide a filtration system which does not require frequent cleaning or emptying.

SUMMARY OF THE INVENTION

In accordance with the invention a novel apparatus and process is provided which avoids the problems with prior art devices as stated above, and which provides added improved operation as well.

In accordance with a first feature of the invention, a novel filtration system is provided in which a large area cylindrical filter is disposed coaxially within a large volume container with an annular air outlet chamber defined between the cylindrical filter and the container. The annular

outlet channel is connected to the vacuum pump of the system.

In operation, abrasion particles and skin are conveyed from the outlet channel of the hand held instrument to the interior of the cylindrical filter and are then entrapped within the large surface area interior of the filter. Filtered air then passes through the filter and into the annular low pressure area surrounding the filter and then into the vacuum pump. Because of the large area of the filter, it need not be replaced frequently and will commonly not require replacement until after about 50 uses (or 50 patient treatments).

A back-up emergency filter is coupled between the annular filter volume and vacuum pump to prevent the flow of abrasion particles to the pump in the event of a failure or accidental bypass of the main filter.

The novel cylindrical filter may be mounted between top and bottom flexible disks or flanges which have a larger diameter than the cylindrical filter to permit the easy and rapid replacement of a new filter assembly after a given time or number of operations. The used sand and removed tissue will be trapped within the filter and between the gaskets during this operation. Note that the gaskets may have connection nipples or simple connection openings for input and output conduits which enter the filter interior and annular chamber respectively.

As an alternative to the above cylindrical filter which is rigid, it is also possible to employ a removable paper bag type of filter which is clamped around the inlet conduit, providing similar benefits to those described above at lower cost.

A novel hand-held head or handpiece is also provided with a novel modified design from that of the prior art.

As a first feature of the novel handpiece a screw-on tip of clear plastic is used which makes threaded engagement with the body of the tool. Thus the tip is easily removed from and replaced on the handpiece body after a single use. The tip is hemispherical in shape and has a sand-blast opening in central axis. Sand input and output channels in the body extend parallel to its central axis and the axis of the tip and are displaced toward opposite sides of the central axis. Thus, the opening in the tip is on the central axis of the tool body but is displaced from the input and output channels. The sand will then sweep past the opening (and skin adjacent thereto) in its travel within the tip to abrade the skin. Moreover, the diameter of the sand input channel to the tip interior is relatively smaller than the output vacuum channel (for example, 1/16 inch versus 1/8 inch respectively). This enables the quicker and easier withdrawal of used sand and skin particles from the interior vacuum chamber formed between the end of the body and the tip and aids in prevention of leakage of sand from the skin area being treated if the tip is removed from the area being treated. Note that in use, the hole in the tip is sealed against the skin area to preserve the vacuum and sand flow within the tip.

As a further feature of the novel handpiece, the entire body is shortened to a length less than about 3 inches. This makes it much easier to manipulate the tip over the surface being treated.

As a still further feature of the new handpiece, a small opening is provided in the side of the tip which can be easily covered by the finger of the operator. Thus, the vacuum pressure within the tip can be immediately changed by the operator without having to reach for the main pressure control at the main housing to which the handpiece is attached. It should be noted that this opening can also be placed in the handpiece body and can communicate with either the said inlet outlet channel and still accomplish the stated function.

As a still further feature of the handpiece, the end of the channel carrying sand to the tip is not restricted by a nozzle, but is of the same diameter as the input channel or even flared out to a larger diameter to prevent clogging of the input channel. The flare may also be used at the end of the output channel adjacent the tip. It has been found that the elimination of the nozzle does not otherwise affect the operation of the system.

As a further feature of the present invention, a novel large volume particle supply reservoir is provided in which, for example, a five pound supply of sand, for example, irregularly shaped aluminum oxide particles of a maximum dimension less than about 120 microns and with sharp irregular edges. A nipple at the bottom of the container is connected to an outlet tube, which in turn is coupled to a particle flow control valve which permits air flow into the conduit to carry the sand around the system with a controlled mass flow. The container can be easily replaced or replenished.

In accordance with an improvement of the present application, the screw-on tip has a central

elongated blade or separator extending along the axis of the tip to its opening to define sand input and outlet channels along the length of the tip to increase the volume of sand which reaches and abrades the area being treated.

BRIEF DESCRIPTION OF THE DRAWING(S)

Figure 1 is a schematic diagram of the novel system of the invention.

Figure 2 is a schematic cross-sectional view of the novel filter structure of Figure 1.

Figure 3 is a top view of Figure 2.

Figure 4 is a cross-sectional view of a prior art handpiece.

Figure 5 is a view of the handpiece of Figure 4 as seen from line 5-5 in Figure 4.

Figure 6 is a view of the handpiece of Figure 4 as seen from line 6-6 in Figure 4.

Figure 7 is a cross-sectional view of a novel handpiece containing many of the features of the present invention.

Figure 8 is a view of the handpiece of Figure 7 as seen from line 8-8 in Figure 7.

Figure 9 is a view of Figure 7 as seen from the line 9-9 in Figure 7.

Figure 10 schematically shows a novel handpiece which contains a sand velocity control aperture in the tool tip.

Figure 11 schematically shows a handpiece which contains an extended sand input channel which extends into the tip interior.

Figure 12 schematically shows enlarged flares at the ends of the input and output channels in the handpiece to prevent clogging.

Figure 13 is a perspective view of a preferred embodiment of the tip portion 32/90/110 of the preceding figures.

Figure 14 is a side view of the tip portion of Figure 13.

Figure 15 is a cross-sectional view of Figure 14 taken across section line 15-15 in Figure 14.

Figure 16 is an end view of Figure 14.

Figure 17 is a perspective view of a preferred handpiece for the replaceable tip of Figures 13 to 16.

Figure 18 is a side view of the handpiece of Figure 17.

Figure 19 is an end view of the handpiece of Figure 18.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to Figure 1, there is shown a supply container 20, which can, for example, contain about 5 pounds of a suitable abrasive sand 21, for example, aluminum oxide particles with very sharp edges and a non-critical maximum dimension of about 120 microns. An output particle supply line 22 which may be a plastic conduit of about 1/4 inch O.D. is connected to a suitable connection nipple (not shown) on the bottom of can 20. A particle flow control valve 23 is provided to control the air flow from atmosphere into supply line 22 to move abrasive particles in the input conduit 30 of handpiece 31; moving sand faster when the valve is closed.

Handpiece 31 further contains a hemispherical shaped tip 32 which is removably connected to body 33. The body 33 contains input

channel 30 and output channel 34 which will be later described in detail. Channel 30 conventionally has a diameter of about 1/8 inch and channel 34 is conventionally about 1 inch in diameter.

Removable tip 32 is a hollow hemispheric structure having a diameter of about 1 inch, a length of about 1 ½ inch, and has a central aperture 35 on its axis. Typically, aperture 35 has a non-critical diameter of 1/4 to 3/8 inch. In use, the aperture 35 is sealed against the surface to be treated and particles from conduit 30 pass by and abrade the skin exposed through aperture 30. The used sand particles and abraded tissue are then removed through channel 34 and are directed to a novel filter 40.

Filter 40 consists of a cylindrical metal container 41 (Figures 2 and 3) which may have a 6 inch diameter and contains a cylindrical pleated filter 42 which may be over-wrapped with a flat filter paper. A standard 3 pound coffee can has been used for can 41. The filters are sized to ensure trapping of the 120 micron sized particles and the abraded tissue. The cylindrical filter 42 is fixed as by cementing at top and bottom to rubber flange disks 43 and 44 respectively best shown in Figures 2 and 3. These may be formed of a silicone rubber about 1/4 inch thick. The top disk 43 has openings 45 and 46 which receive air outlet conduit 47 and an air-plus-particle inlet conduit 48. Conduits 47 and 48 are fused or otherwise sealably connected to openings in disk 43. Conduits 47 and 48 may be flexible plastic tubes with O.D.'s of 3/8 and 1/4 inch respectively.

The disks 43 and 44 are press-fitted into the inner diameter of can 41 and can be glued to the can interior. They form a sealed annular chamber 50

which surrounds filter 42 and communicates with conduit 47.

While filter 42 is shown as a rigid filter fixed between rubber disks 43 and 44, it can be replaced by a simple filter bag suitably clamped to input conduit 48.

In operation, waste particles and tissue flow from the handpiece and into filter 42 and are collected therein. Filtered air flows through the filter 42 and into the low pressure annular volume 50 and out through conduit 47 toward vacuum pump 60. This filtered air also flows through an emergency back-up filter 55 which prevents flow of abrasive particles into vacuum pump 60 (a 1/3 horse power pump) if filter 40 is accidentally bypassed. A 3/8 inch conduit 61 connects filter 55 to pump 60.

A pressure gauge 62 monitors the pressure at the input to pump 60 (reading from 0 to 100KPA vacuum). The exhaust air from pump 60 is exhausted to the exterior atmosphere through muffler 65. A valve 66 controls the vacuum in line 61.

It will be noted that valves 23 and 66 along with selected other elements of the system may be housed in a control box (not shown). The filters 40 and 55 and reservoir 20 are suitably mounted for greatest convenience. The handpiece 31 is connected to the particle supply by the elongated and flexible supply line 22, and to the filter 40 by a similar elongated flexible line 70. Lines 22 and 70 ensure that an operator can manipulate the handpiece 31 as necessary for its use.

Figure 4, 5 and 6 show a prior art type of handpiece 80 which can be used with the novel filter and system of Figures 1, 2 and 3. The handpiece 80

consists of a solid plastic body 81 having a large diameter channel 82 which is coaxial with the axis of body 81 and a smaller diameter outflow channel 83. A restrictive nozzle is commonly placed at the end of channel 82. Body 80 has a length of about 5 inches and a reduced diameter end section 84, about 1 inch long. An 0-ring gasket 85 is fixed around the diameter of section 84, at a point removed from the shoulder 86. A rigid transparent plastic tip 90 is pressed over gasket 85 to form a chamber 91 leading to a central hole or aperture 92.

In use, the hole 92 is pressed (or sealed) against the skin area to be treated. Abrading particles flowing along channel 82 and in line and coaxial with hole 92 impinge on the skin exposed through hole 92 and the used particles and abraded skin are reflected from the skin and are withdrawn through channel 83.

Figures 7, 8 and 9 show a handpiece modified in accordance with several of the features of the invention. Thus body 100 of rigid plastic, for example Teflon, has a central axis 101 (Figure 8 and 9) and off-center inlet and outlet channels 102 and 103 respectively. Note that these channels are reversed in relative sizes from those of Figure 4 and are 1/8 inch and 1/4 inch respectively.

The body 100 has a very short length, less than about 3 inch and has a reduced diameter threaded end section 105. A sealing 0-ring 106 is placed against shoulder 107 between the large diameter and small diameter sections of body 100. A transparent plastic tip 110 is then threaded onto the threaded portion of body extension 105 and compresses 0-ring 106 against shoulder 107 to create a seal. The tip

110 forms a vacuum chamber 111 interior spaced from the end of body 100 and has a central aperture 112 (Figures 7 and 9) which is about 5/16 inch in diameter and is laterally off-set from the axis of channels 102 and 103.

The novel shortened length of handpiece 100 makes it easier for an operator to manipulate the opening 112 over the skin of a patient. Further the large output diameter of channel 103 improves the operation of the device and makes it easier to quickly evacuate particles from chamber 111 to ensure against loss of particles to atmosphere if the handpiece is removed from the skin of a subject, breaking the vacuum in chamber 111.

As a further advantage over prior handpieces, the tip 110 can be easily detached and replaced by a new tip after use on a given patient by simply unscrewing the tip and screwing on a new one for the next patient. In the prior art structure of Figures 4, 5 and 6, the press fit of tip 90 over seal 85 formed a tight fit making it difficult to remove the used tip and replace it with a new one.

Figures 10, 11 and 12 schematically show several novel features for handpiece 31 of Figure 1 which can be used with the handpieces of Figures 4 to 9. Thus, in Figure 10, the tip 31 is shown with a small control opening 119 therein which can be easily closed by the operator's finger to increase the vacuum to produce a more forceful stream of abrasive particles against the skin being abraded when such added force is required. This can be done directly at the handpiece, without requiring the operator to reach for the equipment housing valve 66 in Figure 1.

It should be further noted that the same result can be obtained by placing the control opening in the body of the handpiece and in communication with either the interior of the tip or the input channel or the output channel.

Figure 11 shows a modification in which a tube 120 is added to channel 30 in body 33 to extend the point of exit of new abrading particles closer to opening 35 and the skin being treated.

Figure 12 shows a variation in which the ends of channels 30 and 34 are flared outward at diffuser regions 122 and 123 respectively. It has been found that these diffuser flares tend to prevent clogging of the channels 30 and 34 at their ends entering vacuum chamber 130 formed by tip 31. Note that in prior art handpieces a restriction nozzle has been used at the outlet of channel 30 which has been found to aggravate clogging of the handpiece after a short time.

Figures 13 to 16 show a preferred embodiment of a novel disposable plastic tip 200 which contains a central dividing blade to further define air/sand inlet and outlet channels and Figures 17 to 19 describe a preferred handpiece 300 for holding the tip 200.

Referring first to Figures 13 to 16, the tip 200 is of clear molded plastic and comprises an outer cylindrical body 201 which extends from a knurled base 202 and having an opening 203 which is coaxial with the central axis of the tip 200. A thread 204 is formed at the interior end of base 202. In accordance with an important feature of the invention, a central blade 210 extends from the end of chamber 211 (Figure 15) which receives the handpiece to the apertured end

203 of the tip 200. The end of blade 210 has a cut-out 212 (Figure 15) which defines a connection channel adjacent the end of the tip between the two air/sand channels 213, 214 formed on opposite sides of the blade 210 (Figure 14). This novel blade 210 has been found to substantially increase the volume of airborne sand into the tissue being treated, and the volume being withdrawn therefrom, to and from the handpiece.

Figures 17 to 18 show the preferred handpiece 300 for the tip 200. Handpiece 300 is a unitary molded body and has an enlarged diameter base 301 from which a smaller diameter integral body 302 extends. The base of body 302 carries threads 303 which thread into the threads 204 of tip 200, with body 302 entering and being fixed within volume 211 (Figure 15) of tip 200. A gasket can be compressed between the end of tip 200 and the shoulder 304 on base 301 when the tip 200 is threadably fixed to handpiece 300. As in the prior embodiments, a small diameter inlet channel 310 (0.89 mm diameter) and a large diameter outlet channel 311 (1.9 mm diameter) are provided. These lead to connection nipples 312 and 313 respectively. Note that when the tip 200 is screwed onto hand piece 300, the blade 210 should bisect the openings of nozzles 310 and 311.

Although the present invention has been described in relation to particular embodiments thereof, many other variations and modifications and other uses will become apparent to those skilled in the art. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.

WHAT IS CLAIMED IS:

1. An apparatus for the abrasion of living tissue comprising, in combination;

a container of abrasive particles;

a handpiece for applying an input stream of abrasive particles to a skin surface and for withdrawing an output stream of said particles and tissue from the skin surface;

said handpiece being connected to said container by a connection line to produce said input stream of abrasive particles;

a filter assembly comprised of an outer container and a filter therein which defines a boundary between a central volume enclosed by said filter and an exterior generally annular shaped sealed volume defined between said filter and said outer container; said output stream of particles and tissue being connected by a second connection line to said central volume of said filter;

and a vacuum pump having a vacuum line extending therefrom and connected to said generally annular shaped sealed volume.

2. The apparatus as set forth in claim 1 which further includes a secondary filter disposed in said vacuum line.

3. The apparatus of claim 1 which further includes an air input line connected from ambient to said connection line and a particle flow control valve connected in said air input line.

4. The apparatus of claim 1 which further includes an air input line connected to said vacuum line and having a vacuum strength control valve therein.

5. The apparatus of claim 3 which further includes an air input line connected to said vacuum line and having a vacuum strength control valve therein.

6. The apparatus of claim 1 wherein said filter comprises a rigid cylindrical filter having upper and lower flat parallel rubber disks of diameter larger than that of said filter and said disks being secured thereto and sealed against the interior wall of said container.

7. The apparatus of claim 1 wherein said filter comprises a disposable filter bag.

8. The apparatus set forth in claim 1 wherein said handpiece comprises a rigid elongated body member having a central axis and having a removable tip at one end thereof; said removable tip having an outlet opening which is coaxial with said central axis; said rigid body member having first and second parallel spaced channels therethrough which are respectively connected to said connection line and said second connection line to respectively conduct a stream of abrasive particles toward said tip and to conduct said particles and abraded skin away from said tip; the interior of said tip defining a vacuum chamber between the end of said body and said outlet

opening therein, when said opening is sealed against the skin to be abraded.

9. The apparatus of claim 8 wherein said tip is connected to said body by a threaded connection.

10. The apparatus of claim 8 wherein one of said handpiece and tip have a small opening therein in communication with said interior of said tip to permit the easy change of the vacuum pressure within said vacuum chamber by an operator during use of said handpiece.

11. The apparatus of claim 8 wherein said second channel has larger diameter than said first channel.

12. The apparatus of claim 8 wherein both said first and second channels are laterally displaced from and are on opposite sides of said central axis.

13. The apparatus of claim 8 wherein said handpiece has a total length less than about 3 inches.

14. A handpiece apparatus for skin abrading equipment; said handpiece apparatus comprising a rigid elongated body member having a central axis and having a removable tip at one end thereof; said removable tip having an outlet opening which is coaxial with said central axis; said rigid body member having first and second parallel spaced channels therethrough which are respectively connected to said connection line and to said second connection line to respectively conduct a

stream of abrasive particles toward said tip and to conduct said particles and abraded skin away from said tip; the interior of said tip defining a vacuum chamber between the end of said body and said outlet opening therein when said opening is sealed against the skin to be abraded.

15. The apparatus of claim 14 wherein said tip is connected to said body by a threaded connection.

16. The apparatus of claim 14 wherein said tip has a small opening therein to permit the easy change of the vacuum pressure within said vacuum chamber by an operator during use of said handpiece.

17. The apparatus of claim 14 wherein said second channel has larger diameter than said first channel.

18. The apparatus of claim 15 wherein both said first and second channels are laterally displaced from and are on opposite sides of said central axis.

19. The apparatus of claim 14 wherein said handpiece has a total length less than about 3 inches.

20. The apparatus of claim 15 wherein one of said handpiece and tip have a small opening therein in communication with said vacuum chamber to permit the easy change of the vacuum pressure within said vacuum chamber by an operator during use of said handpiece.

21. The apparatus of claim 20 wherein said second channel has larger diameter than said first channel.

22. The apparatus of claim 21 wherein both said first and second channels are laterally displaced from and are on opposite sides of said central axis.

23. The apparatus of claim 22 wherein said handpiece has a total length less than about 3 inches.

24. The process of abrading skin comprising the steps of;

producing a flow of abrasive sand taken from a supply reservoir and through a first channel in a handpiece and toward the interior surface of a transparent removable tip at the end of said handpiece;

evacuating air from the interior of said removable tip by a vacuum source connected to a second channel which extends through said handpiece;

placing said tip against a surface of the skin to be abraded with an opening in said tip sealed against said skin;

causing a flow of sand within said tip from the end of said first channel and into the end of said second channel, whereby at least a portion of said sand follows a path to abrade skin which is exposed to said sand flow through said opening in said tip is abraded;

said handpiece having a length less than about 3 inch whereby an operator can conveniently manipulate the opening in said tip over a complex

shaped skin surface and can easily keep said opening sealed against said surface.

25. The process of claim 24 wherein one of said handpiece and tip have a second opening therein which is removed from said first mentioned opening, whereby an operator can change the pressure within said tip by manually closing said opening while otherwise manipulating said tip over said skin surface.

26. The process of abrading skin comprising the steps of;

producing a flow of abrasive sand taken from a supply reservoir and through a first channel in a handpiece and toward a first interior volume of a transparent removable tip at the end of said handpiece;

evacuating air from a second interior volume of said removable tip which is laterally adjacent to said first interior volume by a vacuum source connected to a second channel which extends through said handpiece;

placing said tip against a surface of the skin to be abraded with an opening in said tip with both first and second volumes sealed against said skin;

causing a flow of sand within said tip from the end of said first channel and into the end of said second channel, whereby at least a portion of said sand follows a path through said first volume and into said second volume to abrade skin which is exposed to said sand flow through said opening in said tip;

said handpiece having a length less than about 3 inch whereby an operator can conveniently manipulate the opening in said tip over a complex shaped skin surface and can easily keep said opening sealed against said surface.

27. A handpiece apparatus for skin abrading equipment; said handpiece apparatus comprising a rigid elongated body member having a central axis and having a removable tip at one end thereof; said removable tip having an outlet opening which is coaxial with said central axis; said rigid body member having first and second parallel spaced channels therethrough which are respectively connected to a first connection line and a second connection line respectively to conduct a stream of abrasive particles toward said tip and to conduct said particles and abraded skin away from said tip; at least a portion of the interior of said tip defining a vacuum chamber between the end of said body and said outlet opening therein when said opening is sealed against the skin to be abraded and a central blade extending fully across the interior of said removable tip and extending from a position against said outlet opening to a position adjacent the end of said rigid body member to separate the flow of particles toward and away from said tip.

28. The apparatus of claim 27 wherein said tip is connected to said body by a threaded connection.

29. The apparatus of claim 27 wherein said second channel has larger diameter than said first channel.

30. The apparatus of claim 27 wherein both said first and second channels are laterally displaced from and are on opposite sides of said central axis and are on opposite sides of said central blade.

31. The apparatus of claim 27 wherein said handpiece has a total length less than about 3 inches.

32. The apparatus of claim 28 wherein both said first and second channels are laterally displaced from and are on opposite sides of said central axis and are on opposite sides of said central blade.

33. The apparatus of claim 29 wherein both said first and second channels are laterally displaced from and are on opposite sides of said central axis and are on opposite sides of said central blade.

34. The apparatus of claim 31 wherein both said first and second channels are laterally displaced from and are on opposite sides of said central axis and are on opposite sides of said central blade.

35. The device of claim 27 wherein the end of said blade adjacent said opening has an arcuate cut out to permit communication from opposite sides of said blade and across said opening.

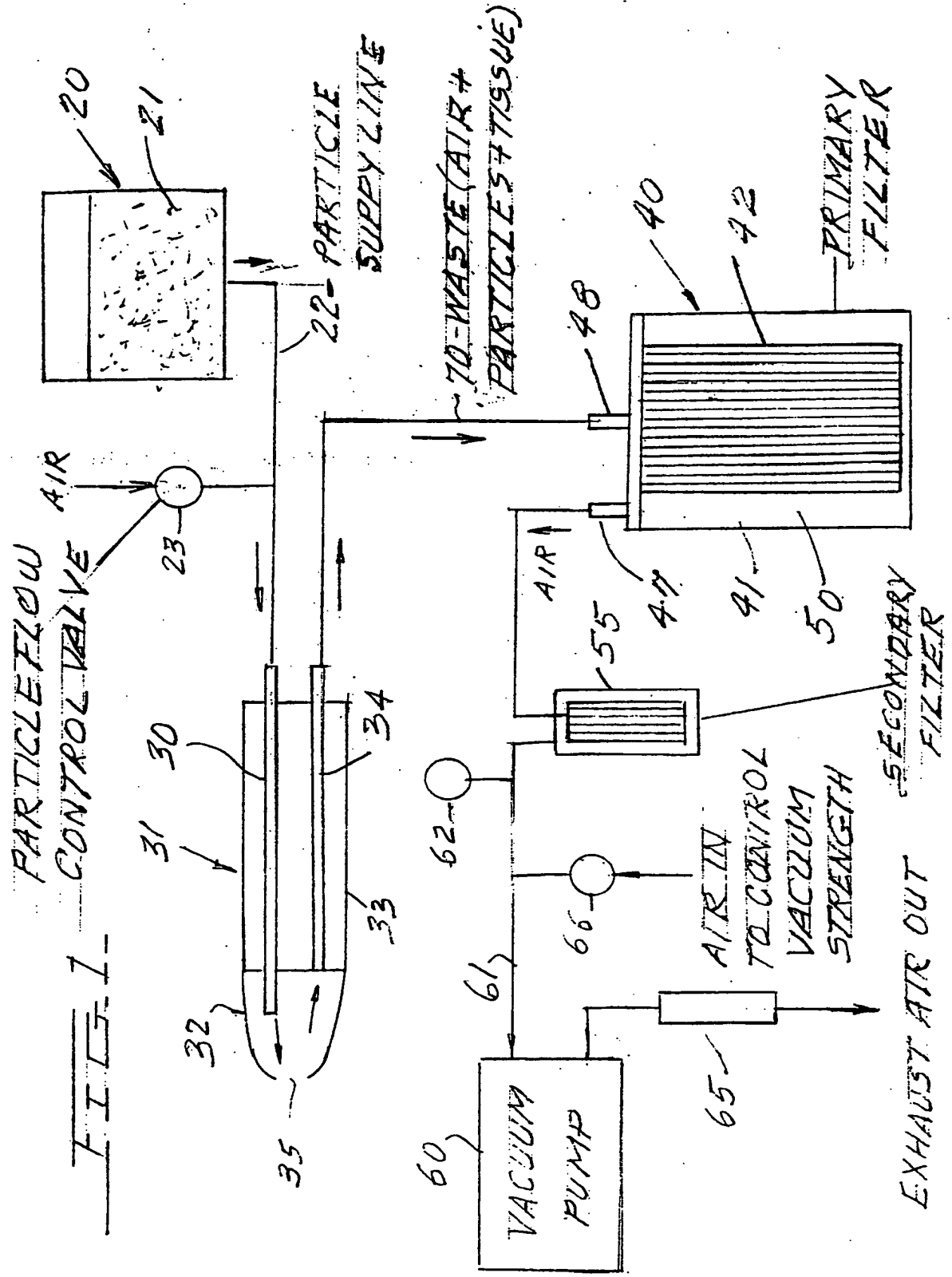

20
21
22
PARTICLE SUPPLY LINE
TO-WASTE (AIR + PARTICLES + TISSUE)
48
40
42
PRIMARY FILTER
AIR
23
PARTICLE FLOW CONTROL VALVE
AIR
55
49
41
50
SECONDARY FILTER
30
34
31
33
32
35
62
66
61
AIR IN TO CONTROL VACUUM STRENGTH
60
VACUUM PUMP
65
EXHAUST AIR OUT

FIG. 1

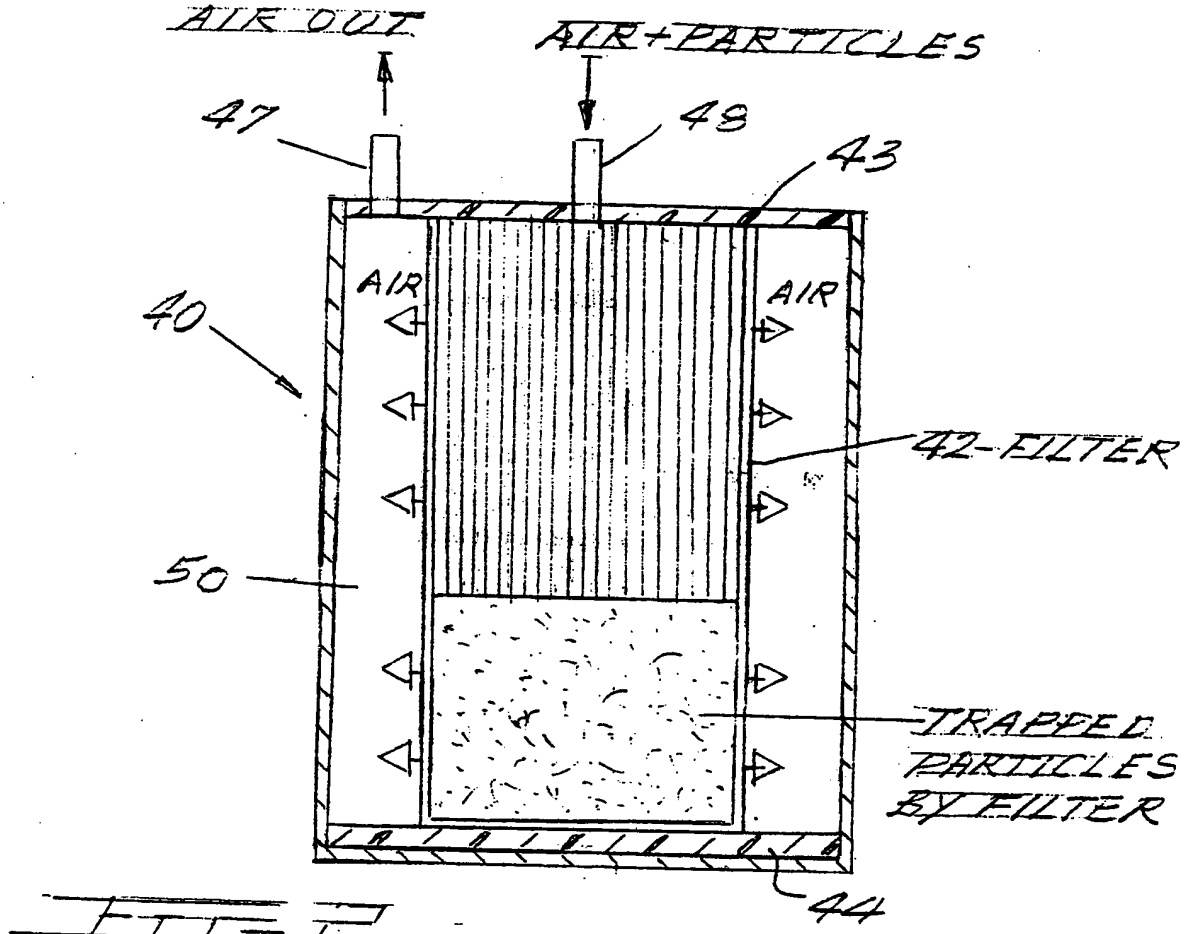

AIR OUT
AIR+PARTICLES
47
48
43
AIR
AIR
40
42-FILTER
50
TRAPPED PARTICLES BY FILTER
44

FIG 2

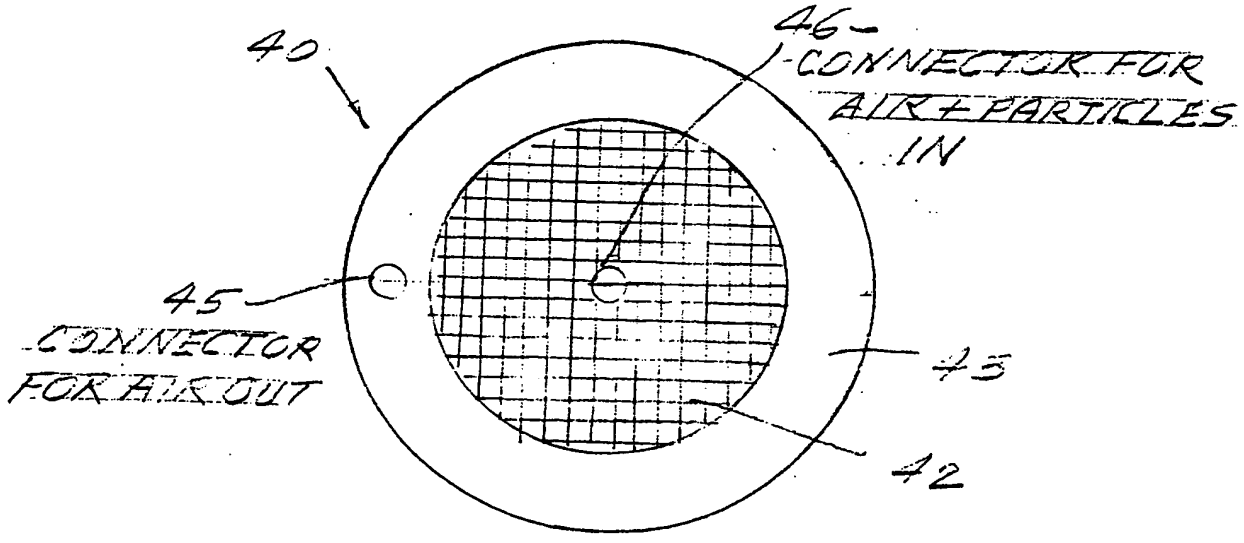
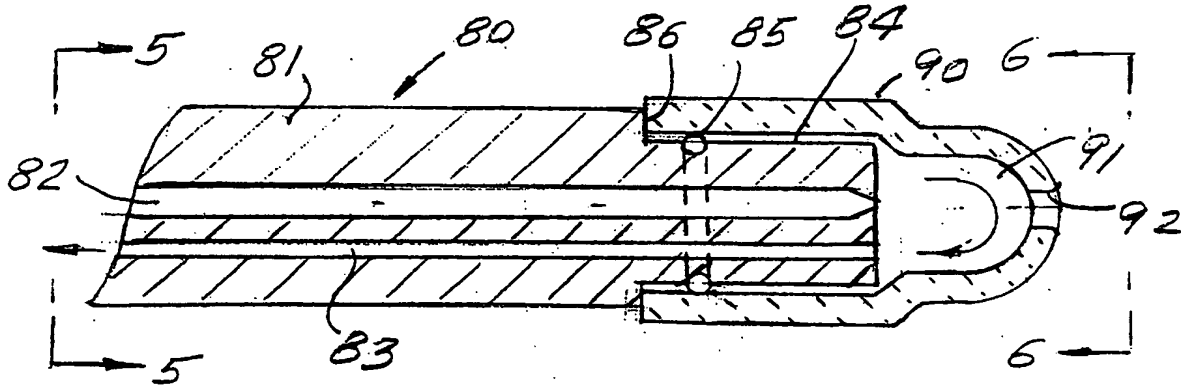

40
46-CONNECTOR FOR AIR+PARTICLES IN
45
CONNECTOR FOR AIR OUT
43
42

FIG 3

FIG. 4 (PRIOR ART)



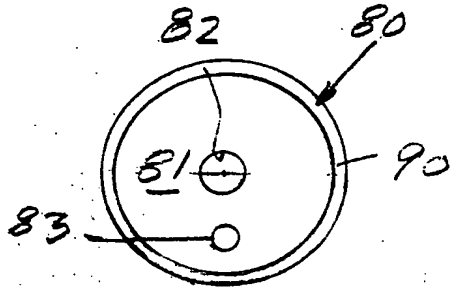


FIG. 5

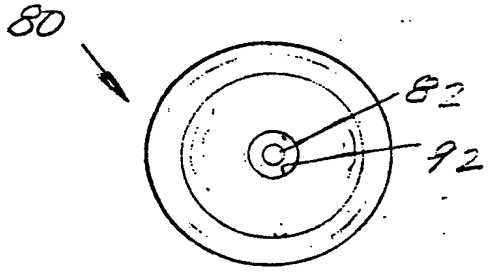


FIG. 6

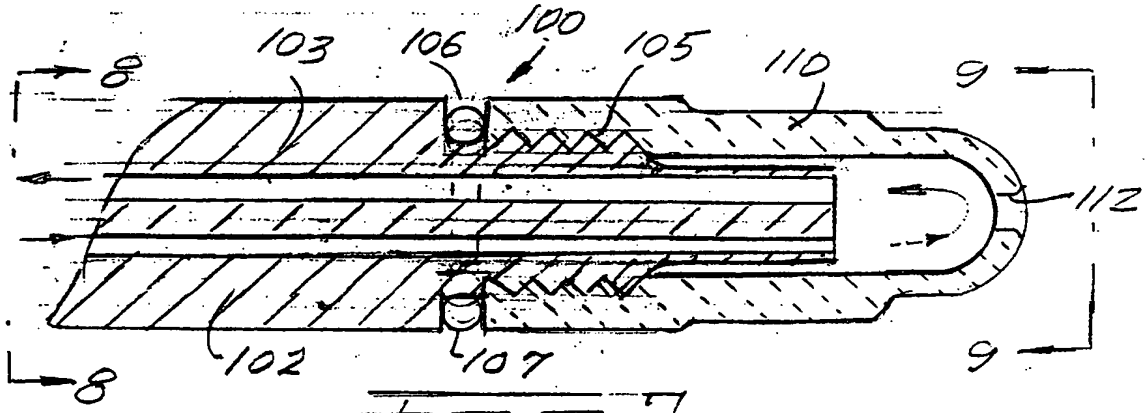


FIG. 7

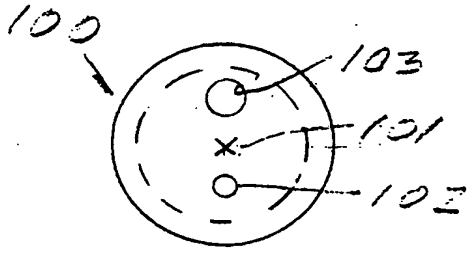


FIG. 8

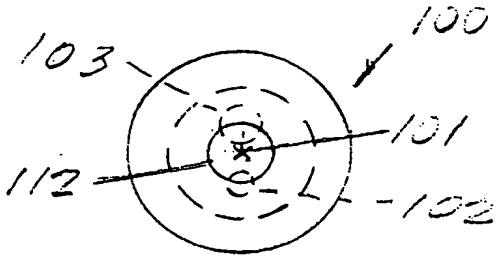


FIG. 9

FIG. 10

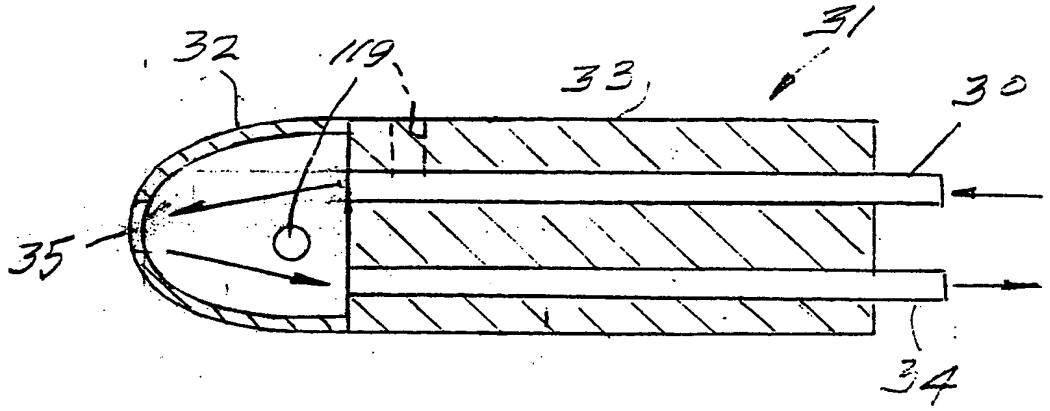


FIG. 11

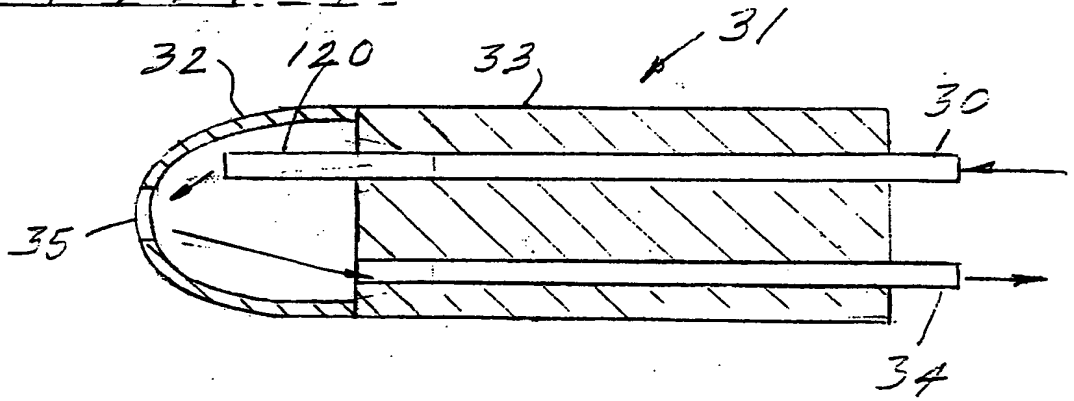
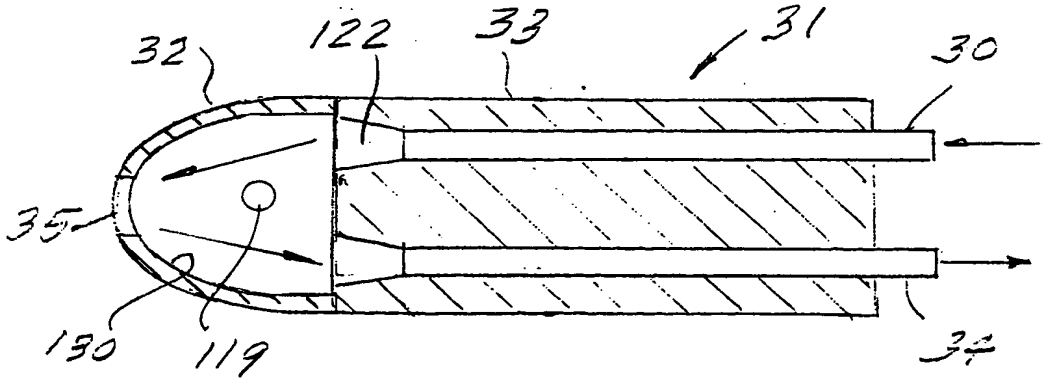


FIG. 12



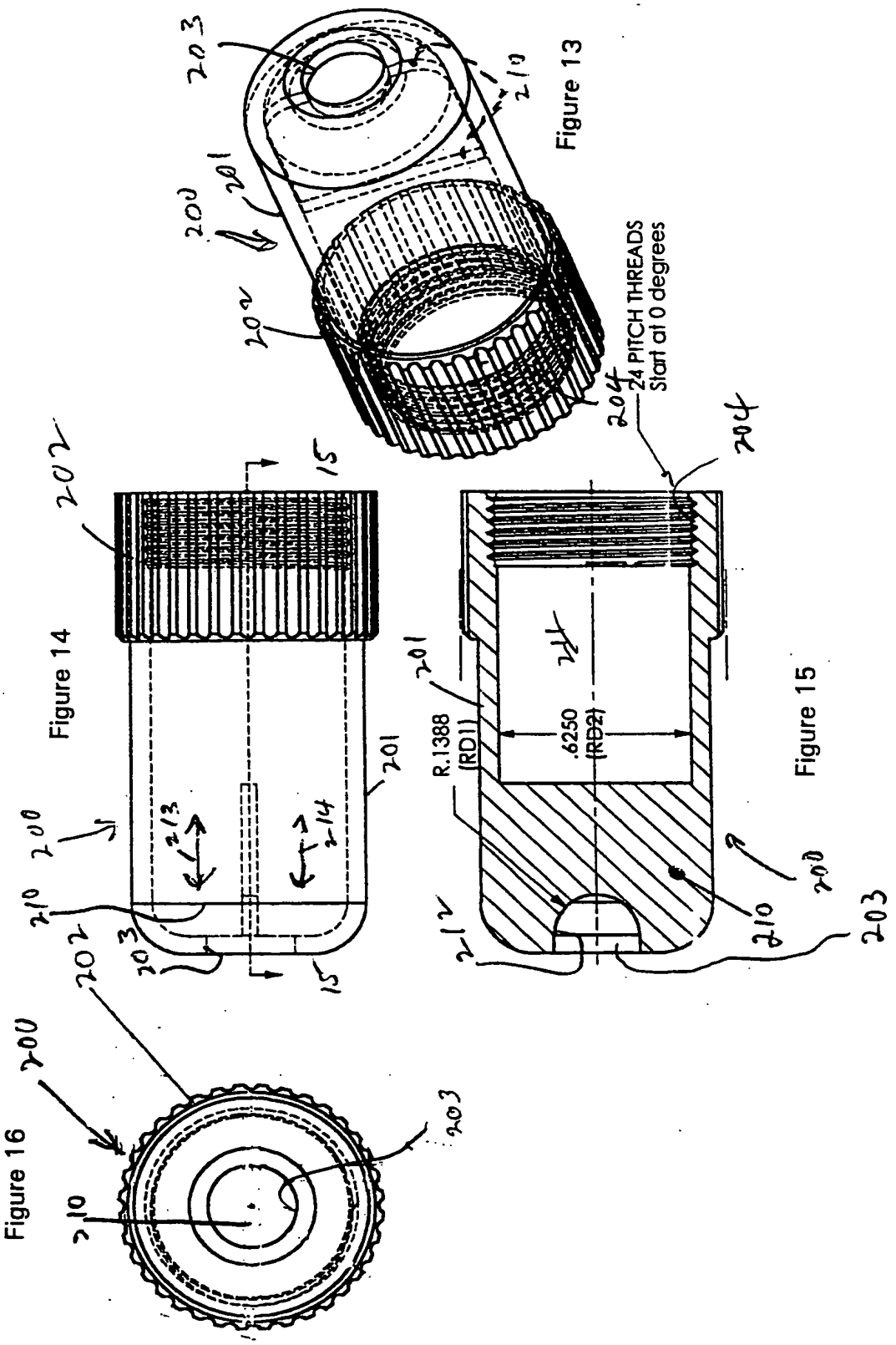


Figure 13

Figure 14

Figure 15

Figure 16

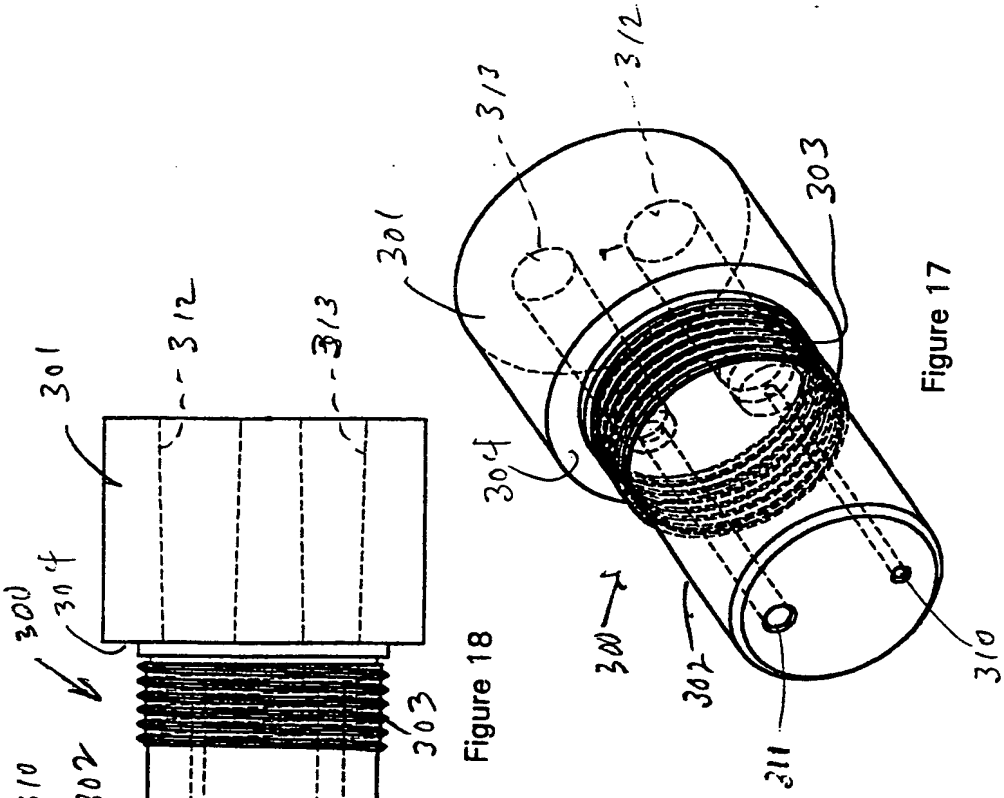


Figure 17

Figure 18

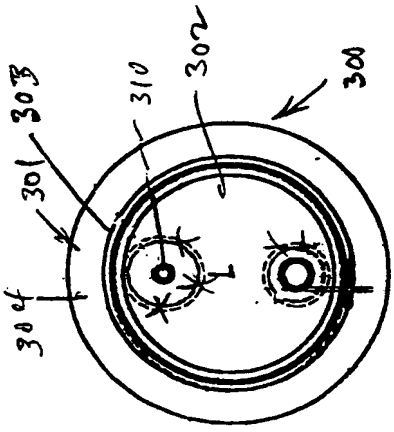


Figure 19

INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 00/04171

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B17/54 A61M1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B A61M A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 564 392 A (FRUCTUOSO MARTINEZ) 6 October 1993 (1993-10-06) abstract; figures column 7, line 13-54	1-8, 11-14, 17,19, 24,26
Y A		10,16,25 27
Y	US 3 974 833 A (DURDEN, III) 17 August 1976 (1976-08-17) abstract; figures 21-24 column 9, line 31-40	10,16,25

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 May 2000	07/06/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Giménez Burgos, R

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INTERNATIONAL SEARCH REPORT

Inte. .onal Application No
PCT/US 00/04171

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 712 172 A (RABIER) 19 May 1995 (1995-05-19) the whole document	1,2,7,8, 12-14, 19,24,26
Y		9,15,18
A		27
Y	WO 97 00050 A (NALDONI) 3 January 1997 (1997-01-03) abstract; figures page 13, line 12-24	9,15,18
A	WO 97 11650 A (CAWLEY) 3 April 1997 (1997-04-03) abstract; figures	1,14,24, 26,27
P,X	WO 99 23951 A (GREENBERG) 20 May 1999 (1999-05-20) abstract; figures	1-6,8, 12-14, 17,19, 24,26

1

INTERNATIONAL SEARCH REPORT

information on patent family members

Inter .onal Application No
PCT/US 00/04171

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0564392	A	06-10-1993	ES	2091698 A	01-11-1996
			ES	2130874 A	01-07-1999
			ES	2104488 A	01-10-1997
US 3974833	A	17-08-1976	US	3825004 A	23-07-1974
			CA	1006231 A	01-03-1977
FR 2712172	A	19-05-1995	NONE		
WO 9700050	A	03-01-1997	IT	FI950135 A	16-12-1996
			DE	69606176 D	17-02-2000
			EP	0831748 A	01-04-1998
			US	5971999 A	26-10-1999
WO 9711650	A	03-04-1997	AU	7091996 A	17-04-1997
			GB	2319480 A,B	27-05-1998
WO 9923951	A	20-05-1999	AU	717885 B	06-04-2000
			AU	1014299 A	31-05-1999